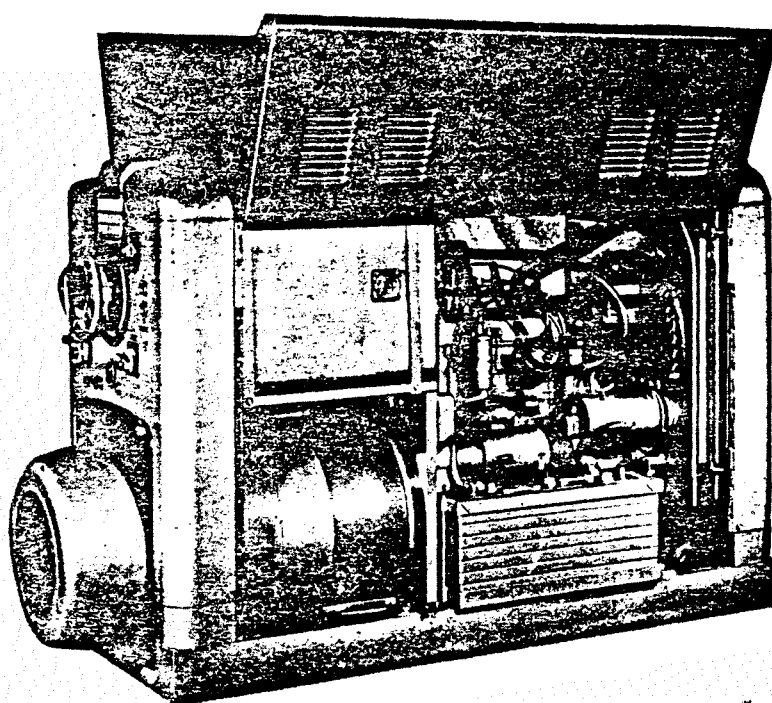
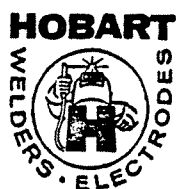


INSTRUCTIONS

- *installation*
- *operation*
- *maintenance*



PIPELINER and MAINLINER



250 AMPERE

GASOLINE ENGINE DRIVEN

ARC WELDER

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SAFETY INSTRUCTIONS AND WARNINGS

FOR OPERATION OF ARC WELDING EQUIPMENT

IMPORTANT - READ AND UNDERSTAND THESE INSTRUCTIONS. DO NOT LOSE THEM. ALSO READ OPERATING/INSTRUCTION MANUAL *BEFORE* INSTALLING, OPERATING, OR SERVICING THIS EQUIPMENT.

A. GENERAL

Welding products and welding processes can cause serious injury or death, or damage to other equipment or property, if the operator does not strictly observe all safety rules and take precautionary actions.

Safe practices have developed from past experience in the use of welding and cutting. These practices must be learned through study and training before using this equipment. Anyone not having extensive training in welding and cutting practices should not attempt to weld. Certain of the practices apply to equipment connected to power lines; other practices apply to engine driven equipment.

Safe practices are outlined in the American National Standard Z49.1 entitled: **SAFETY IN WELDING AND CUTTING**. This publication and other guides to what you should learn before operating this equipment are listed in Section K for your convenience in ordering them.

B. MACHINES OR SYSTEMS EQUIPPED WITH A HIGH FREQUENCY GENERATOR USED IN TIG WELDING

High frequency power may be hazardous. People who wear pacemakers or other electronic equipment vital to life should check with the life support manufacturers and their clinician to determine whether a hazard exists.

C. SHOCK PREVENTION

Bare conductors, or terminals in the output circuit, or ungrounded, electrically-live equipment can fatally shock a person. To protect against shock, have a competent electrician verify that the equipment is adequately grounded. Do not make contact with terminals and parts that are electrically HOT.

The body's electrical resistance is decreased when wet, permitting dangerous currents to flow through the body. Do not work in damp area without being extremely careful. Stand on dry rubber mat or dry wood and use insulating gloves when dampness or sweat cannot be avoided. Keep clothing dry.

1. Installation and Grounding of Electrically Powered Equipment - Electrical equipment must be installed and maintained in accordance with the National Electrical Code, NFPA 70, and local codes. A power disconnect switch must be located at the equipment. Check nameplate for voltage and phase requirements. If only 3-phase power is available, connect *single-phase* equipment to only two wires of the 3-phase line. **DO NOT CONNECT** the equipment grounding conductor (lead) to the third live wire of the 3-phase line as this makes the equipment frame electrically HOT, which can cause a fatal shock.

SAFETY INSTRUCTIONS AND WARNINGS

If a grounding lead (conductor) is part of the power supply cable, be sure to connect it to a properly grounded switch box or building ground. If not part of the supply cable, use a separate grounding lead (conductor). Do not remove a ground prong from any plug. Use correct mating receptacles. Check ground for electrical continuity before using equipment.

2. Electrode Holders - Use only fully insulated electrode holder. Keep in good condition. Tighten screws so handle and other insulated parts stay in place. Never dip holder in water to cool it, or lay it down on ground or on work surface. Do not touch holders connected to two welding machines at the same time, or touch other people with the holder or electrode.

3. Welding Leads - Inspect leads often for damage to the insulation. Replace or repair cracked or worn leads immediately. Do not loop lead around your body. Do not use a welding current in excess of rated lead capacity, as the lead will overheat.

4. Output Terminals - Do not touch output terminals or make contact with machine while equipment is operating.

5. Electrode Wire - The electrode wire is electrically HOT when the equipment power switch is in ON position and the gun trigger is depressed. Do not touch electrode wire or "live" parts of wire feeder.

6. Service and Maintenance - Shut OFF all power at the disconnect switch or line breaker *before* inspecting or servicing the equipment. Lock switch OPEN (or remove line fuses) so that power cannot be turned ON accidentally. Disconnect power to equipment if it is to be left unattended or out of service.

7. Replace fuses with equivalent sizes.

D. BURN PREVENTION

The welding arc is very bright and hot. Sparks go everywhere, weldments are hot, and ultraviolet and infrared radiation is present. These arc rays penetrate lightweight clothing and are reflected from light-colored surfaces. The arc rays can injure the eyes *permanently* and burn the skin, just as in too much sunburn. Never look at an electric arc without eye protection. Be sure that there is sufficient distance between personnel welding so sparks will not strike other personnel in the area.

1. Protective Clothing - Wear dry gloves, jackets or sleeves, and aprons of chrome leather, safety shoes, welding helmet, and other articles needed to shield the skin and to prevent injury from arc burns. Wear ear plugs if welding overhead or in a confined space. Wear a hard hat if others are working above you.

2. Eye and Head Protection - Protect your eyes and head by wearing a welding helmet fitted with a double lens; use a clear lens outside and a colored, arc-ray lens inside as shown on following page.

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Eye protection filter shade selector for welding or cutting (goggles or helmet), from AWS A6.2-73.

Welding or Cutting Operation	Electrode Size Metal Thickness or Welding Current	Filter Shade Number
Torch soldering	-	2
Torch brazing	-	3 or 4
Oxygen cutting		
Light	Under 1 in., 25 mm	3 or 4
Medium	1 to 6 in., 25-150 mm	4 or 5
Heavy	Over 6 in., 150 mm	5 or 6
Gas welding		
Light	Under 1/8 in., 3 mm	4 or 5
Medium	1/8 to 1/2 in., 3-12 mm	5 or 6
Heavy	Over 1/2 in., 12 mm	6 or 8
Shielded metal-arc welding (stick) electrodes	Under 5/32 in., 4 mm	10
	5/32 to 1/4 in., 4 to 6.4 mm	12
	Over 1/4 in., 6.4 mm	14
Gas metal-arc welding (MIG)		
Non-ferrous base metal	All	11
Ferrous base metal	All	12
Gas tungsten arc welding (TIG)	All	12
Atomic hydrogen welding	All	12
Carbon arc welding	All	12
Plasma arc welding	All	12
Carbon arc air gouging		
Light		12
Heavy		14
Plasma arc cutting		
Light	Under 300 Amp	9
Medium	300 to 400 Amp	12
Heavy	Over 400 Amp	14

Warning

THE USE OF GAS WELDING GOGGLES CAN CAUSE EYE DAMAGE WHEN ARC WELDING OR CUTTING. Use helmet with proper lens shade instead.

Always lower the helmet before striking the arc. Wear safety glasses with side shields under the

helmet to protect the eyes from flying particles and side arc flashes when the helmet is up.

Protect the eyes of other people in the area by use of opaque, non-reflecting and non-flammable screens around your welding station. Allow good air circulation, especially at floor level. Do not permit anyone to view the arc unless he uses a correct handshield, or helmet.

SAFETY INSTRUCTIONS AND WARNINGS

A special hazard to eyes are flying particles caused by grinding, chipping and removing slag from welds. Wear safety goggles with side shields. Instruct others in the area to use them.

For eyeburn, see Section I. on page 6.

E. FIRE AND EXPLOSION PREVENTION

Fire and explosion are caused by combustible material being ignited by the welding arc or flame, flying sparks, hot weld slag, electrical short circuits, hot engine exhaust piping, and misuse of compressed gases, batteries, and gasoline. Sparks and molten metal can travel a considerable distance.

1. Welding Area - Do NOT weld or cut if combustible materials are in area or while servicing batteries (see Para. 5 below). Move the work or the combustibles. If combustibles cannot be moved, protect with fire-resistant cover. Do not weld in locations with a flammable atmosphere, such as produced by degreasing, cleaning, spray painting operations, or in atmospheres containing explosive vapors, gases, mists, or dusts.

2. Fire Watcher - If welding or cutting on combustible walls, ceilings and floors, or if combustibles cannot be moved, provide a fire watcher and fire extinguishers during and after the operation. Check that area is free of glowing or smoldering material before leaving the area.

3. Containers - Do not strike an arc on a compressed gas cylinder or

other pressure vessel. This may create brittle areas which may rupture. Do not weld or cut containers in which flammable material have been stored. If absolutely necessary to do so, clean container thoroughly as described in AWS Standard A6.0. See Section K for ordering information for this Standard.

4. Engine Fuel - Use only approved fuel container or fueling system. Shut unit DOWN before removing fuel tank cap. Do not completely fill tank, because heat from the equipment may expand the fuel enough to cause it to overflow. If fuel spillage does occur, wipe up all fuel before starting the engine. If fuel penetrates the enclosure or canopy, remove enough parts to permit complete cleanup. Open canopy doors and blow compressed air over equipment to clear away the fumes.

5. Battery - Batteries give off flammable hydrogen gas. When servicing, do not smoke, cause sparking, or use open flame near the battery.

6. Disposable Butane Lighters - Do not carry since the leaking fumes can be ignited from sparks or molten slag.

7. Pipe Thawing, Battery Charging, And Other Non-welding Applications - Use of a welding machine to thaw frozen water pipes or to do other non-welding work can cause fire, explosion, personal injury and damage to buildings, other equipment, and the welding machine. Do not use any welding equipment for any purpose other than welding.

SAFETY INSTRUCTIONS AND WARNINGS

F. TOXIC FUME PREVENTION

Breathing the fumes created during welding or cutting can cause illness or death, if adequate ventilation is not provided. Provide ventilation in accordance with ANSI Standard Z49.1. See Section K for where to order. Also read warnings located on the containers of welding electrodes and wires and on welding equipment. Do NOT ventilate with oxygen.

Some FUME SOURCES are:

1. Weldments - Metals containing lead, cadmium, zinc, mercury, and beryllium can produce harmful toxic fumes when welded or cut. Adequate local exhaust ventilation must be used for the operator and persons in the area. Use both an air-supplied respirator and exhaust ventilation when welding or cutting beryllium.
2. Coated Weldments - Remove coatings that emit toxic fumes when heated or use exhaust ventilation and/or an air-supplied respirator.
3. Vessels That Have Contained Toxic Materials - Vapors from chlorinated solvents can be decomposed by the arc to form the highly toxic gas called PHOSGENE or other damaging products. The ultraviolet radiant energy of the arc can also decompose trichloroethylene and perchloroethylene vapors to form PHOSGENE. Do not weld or cut unless such containers have been thoroughly cleaned as per AWS Standard A6.0. See Section K for ordering information.
4. Welding Area - Do not weld or cut in locations close to chlorinated vapors coming from degreasing, cleaning or spraying operations. The heat and rays from the arc react

with the vapors to form highly toxic PHOSGENE. Work in a confined space only if it is being adequately ventilated, and if ventilation is not adequate, wear an air-supplied respirator (see ANSI 2.37). Do not weld/cut in an area where gas leaks are suspected.

5. Carbon Monoxide - Engine exhaust fumes can kill. Carbon monoxide gas is odorless, colorless, and highly toxic. Pipe or vent the exhaust fumes to a suitable exhaust duct or to the outdoors. Never locate the engine exhaust near an intake duct or air conditioner.

G. BODILY INJURY PREVENTION

Serious injury can result from contact with fans, belts, pulleys, or hot surfaces inside the equipment. Shut DOWN equipment for inspection and routine maintenance. Use extreme care when equipment is in operation for necessary troubleshooting and adjustment. Be sure arc guards are in place and doors are secured before starting to weld.

H. COMPRESSED GAS EQUIPMENT

Follow precautions below and those outlined in CGA Standard P-1, Precautions For Safe Handling Of Compressed Gases In Cylinders. See Section K for ordering information.

1. Cylinders - Handle carefully to prevent damage. Keep away from welding cables or other electrical circuits. Use only cylinders with name of gas marked on them; DO NOT rely on color identification. Close valves on empties and return promptly. Secure cylinders so they cannot be knocked over. Keep temperature below 130°F. Do not refill any cylinder.

SAFETY INSTRUCTIONS AND WARNINGS

2. Hose - Use the type hose designed for the particular gas to be used. Color identification of hoses is: Green for oxygen, black for inert gases, red for fuel gas. Prevent damage to hoses. Replace or repair if worn or cracked. Use recommended fittings.

3. Pressure Regulators - Use the correct regulator for the gas and cylinder at hand. Remove any suspected faulty regulator and return to manufacturer's service center for repair.

4. Cylinder Valves - Open slowly so that regulator pressure increases slowly. When gage is pressurized, leave cylinder valve in these positions: For inert gases and oxygen, open fully; for fuel gas, open to less than one turn so valve can be quickly closed in an emergency.

I. MEDICAL AND FIRST AID TREATMENT

First aid facilities and a qualified first aid person should be available for each shift for immediate treatment of electrical shock victims. A medical facility should be close by for immediate treatment of flash burns of the eye and skin burns.

EMERGENCY FIRST AID

Call physician and ambulance immediately. Use First Aid techniques recommended by American Red Cross.

DANGER - ELECTRIC SHOCK CAN BE FATAL. If person is unconscious and electric shock is suspected, do not touch person if he or she is in contact with welding leads, welding equipment, or other live electrical parts. Disconnect (open) power at

wall switch and then use First Aid. Dry wood, wooden broom, and other insulating material can be used to move cables, if necessary, away from person.

IF BREATHING IS DIFFICULT, give oxygen. IF NOT BREATHING, BEGIN ARTIFICIAL BREATHING, such as mouth-to-mouth. IF PULSE IS ABSENT, BEGIN ARTIFICIAL CIRCULATION, such as external heart massage.

IN CASE OF EYEBURN, obtain professional medical attention immediately.

J. EQUIPMENT WARNING LABELS

Inspect all precautionary labels on the equipment. Order and replace all labels that cannot be easily read. Also replace all warning and caution labels when replacing sheet metal parts.

K. ADDITIONAL SAFETY AND HEALTH INFORMATION

For more information, order the following standards or their latest revisions. Take action as applicable:

1. ANSI Standard Z49.1, SAFETY IN WELDING AND CUTTING. Order from the American Welding Society, P.O. Box 351040, 550 N.W. LeJeune Rd., Miami, Fla. 33125.
2. ANSI Standard Z87.1, SAFE PRACTICE FOR OCCUPATION AND EDUCATIONAL EYE AND FACE PROTECTION. Order from American National Standards Institute, 1430 Broadway, New York, N.Y. 10018.
3. ANSI Standard Z41.1, Standard for Men's Safety-Toe Footwear. Order from same as Item 2.

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4. American Welding Society Standard F4.1-80, WELDING AND CUTTING CONTAINERS WHICH HAVE HELD COMBUSTIBLES. Order same as for Item 1.
5. OSHA Standard 29 CFR, Part 1910, Subpart Q, WELDING, CUTTING AND BRAZING. Order from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.
6. NFPA Standard 51, OXYGEN-FUEL GAS SYSTEMS FOR WELDING AND CUTTING. Order from the National Fire Protection Association, Batterymarch Park, Quincy, Mass. 02269.
7. NFPA Standard 51B, CUTTING AND WELDING PROCESSES. Order same as for Item 6.
8. CGA Pamphlet P-1, SAFE HANDLING OF COMPRESSED GASES IN CYLINDERS. Order from the Compressed Gas Association, 1235 Jeff Davis Hwg., Arlington, Virginia 22202.
9. CSA Standard W117.2, CODE FOR SAFETY IN WELDING AND CUTTING. Order from Canadian Standards Association, 178 Rexdale Boulevard, Rexdale, Ontario, Canada M9W 1R3.

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PART ONE

INTRODUCTION

SECTION 1 - GENERAL

1. SCOPE

a. GENERAL - These instructions are published for the information and guidance of personnel to whom this equipment is assigned. They contain information on the operation, adjustment and maintenance of the unit. They apply only to the standard Hobart 'Pipeliner' and 'Mainliner', gasoline-engine-driven, D.C. arc welders. The instructions are divided into four parts: Part One - INTRODUCTION, Part Two - OPERATING INSTRUCTIONS, Part Three - MAINTENANCE INSTRUCTIONS, and Part Four - REPAIR AND OVERHAUL.

b. NOTE - This instruction book should be used in conjunction with the 'Willys Industrial Engine Manual and Parts List for 4 & 6 Cylinder Engines', a copy of which is included with each new arc welding unit. Additional copies of this manual are available from:

Factory Parts Department
Industrial Engine Sales Division
Willys Motors, Inc.
Toledo, Ohio

at \$1.50 per copy. When writing for additional copies, give the model and the serial number of the engine.

c. MODELS COVERED - This manual covers two similar machines; the 'Pipeliner' and the 'Mainliner'. (See Figs. 1-2). The 'Pipeliner' is available in two basic models; Model G-257, which has a magneto ignition and is hand cranked, and Model G-258, which is equipped with a battery ignition and a self-starter. The 'Mainliner' comes in two similar models; Model G-260 equipped with magneto ignition and hand crank, and Model G-261 equipped with a battery ignition and self-starter. Several variations of these basic models are available, and the more common variations are discussed in Para. 4.

A special Diesel-driven 'Mainliner', Model D-261, is also available but is not discussed in this manual. Write to the Hobart Brothers Company for information concerning the Diesel 'Mainliner'.

d. TERMINOLOGY - In this manual 'front' is considered as being the radiator end of the welding unit. Right and left are determined by standing facing the rear (control panel) of the welder.

SECTION 2 - DESCRIPTION AND DATA

2. DESCRIPTION

a. 'PIPELINER' - The Hobart 'Pipeliner' gasoline-engine-driven arc welder is a self-contained welding unit mounted on a welded steel frame. The unit is covered by a sheet-metal canopy bolted directly to the frame. The control panel is at the back (generator end) of the unit. A 4-cyl., L-head engine of conventional design drives the welding generator through a flexible coupling.

b. 'MAINLINER' - The 'Mainliner' welder is of the same design, construction and capacity as the 'Pipeliners' model. However, the 'Mainliner' carries as standard equipment, a polarity switch and hinged side panels which can be locked in place.

c. ENGINE - The engine is a Willys, 4-cyl, 4-cyc, water-cooled gasoline engine developing 35.5 hp at the 1800-rpm operating speed. It is directly connected to the welding generator by a flexible coupling. Self-starting units are equipped with a 12-volt ignition system, a self-starting motor, a generator, a generator-voltage regulator, an oil filter, and an air cleaner. The speed of the engine is controlled by a mechanical-type governor.

When the engine is equipped with magneto ignition (hand crank), the starter, generator, distributor, voltage regulator, and battery are not furnished.

d. WELDING-GENERATOR - The welding generator is mounted on a single, heavy-duty shaft with a ball bearing at the generator end. The unit is rated at 40-volts, 250 amps at 60% duty cycle, and has a current range of 30-360 amp. The welder is cooled by a large, squirrel-cage-type fan that draws cool air in at both ends of the welding generator, and expels the heated air at the center.

e. ENGINE CONTROLS - The engine controls for the battery equipped units are on the lower portion of the rear canopy panel. They consist of the battery charging ammeter, choke, starter pushbutton and keylock ignition switch.

The engine controls for those units equipped with a magneto (hand crank) consist of an ON-OFF toggle switch and a choke, conveniently mounted on the front canopy panel. The starting crank is mounted on top of the steel frame along the right side of the unit.

f. WELDING-GENERATOR CONTROLS - The welding generator controls are mounted on the rear canopy panel, just above the engine controls. They consist of the multi-range switch, volt-amp adjuster or field rheostat, ground and electrode terminals, and a 110-V D.C. double outlet receptacle. When specified on an order, a voltmeter and an ammeter are also located on this panel.

On the 'Mainliner' and specially equipped 'Pipeliners' a polarity switch is also located on this rear canopy panel.

g. IDENTIFICATION - The 'Pipeliners' and 'Mainliner' welders have an identification nameplate mounted on the rear canopy panel, just above or below the multi-range switch. The engine identification nameplate is located on the right side of the engine block, just back of the water pump. When ordering spare parts or communicating with us about this machine, please, be sure to specify the engine serial number as well as the specification and serial numbers of the welding unit.

3. TABULATED DATA - The performance data for the 'Pipeliner' and the 'Mainliner' welders is the same and is listed below. Due to the hinged side panels, the standard 'Mainliner' weighs more than the 'Pipeliner'

a. GENERAL

Weight 'Pipeliner'	1175 lbs.
Weight 'Mainliner'	1190 lbs.
Length	64 in.
Width	24 in.
Height	44½ in.

b. GENERATOR PERFORMANCE

Output (kw)	10 kw.
Amperage (rated)	250 amp.
Voltage (rated)	40 volt
Current Range	30-360 amp.
Duty Cycle	60 %
Operating speed	1800 rpm

c. ENGINE PERFORMANCE

Make of Engine	Willys
Type	4-cycle
No. of Cylinders	4-cyl.
Firing Order	1-3-4-2
Bore	3-1/8 in.
Stroke	4-3/8 in.
Displacement	134 cu. in.
Compression Ratio	6.48:1
Brake Horsepower	35.5 at 1800rpm
Operating Speed	1800 rpm

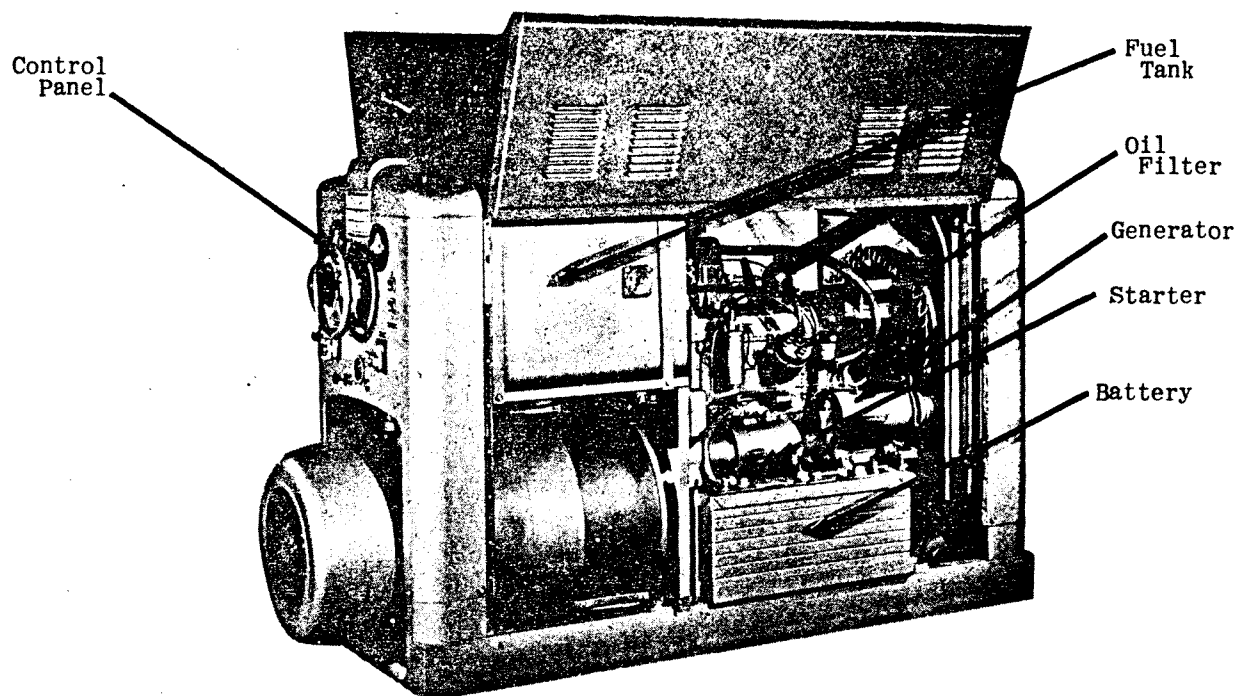
d. OTHER INFORMATION

Radiator Capacity	5 gal
Fuel Tank Capacity	24 gal
Crankcase Capacity	4 qts
Spark Plug Size	14 mm.

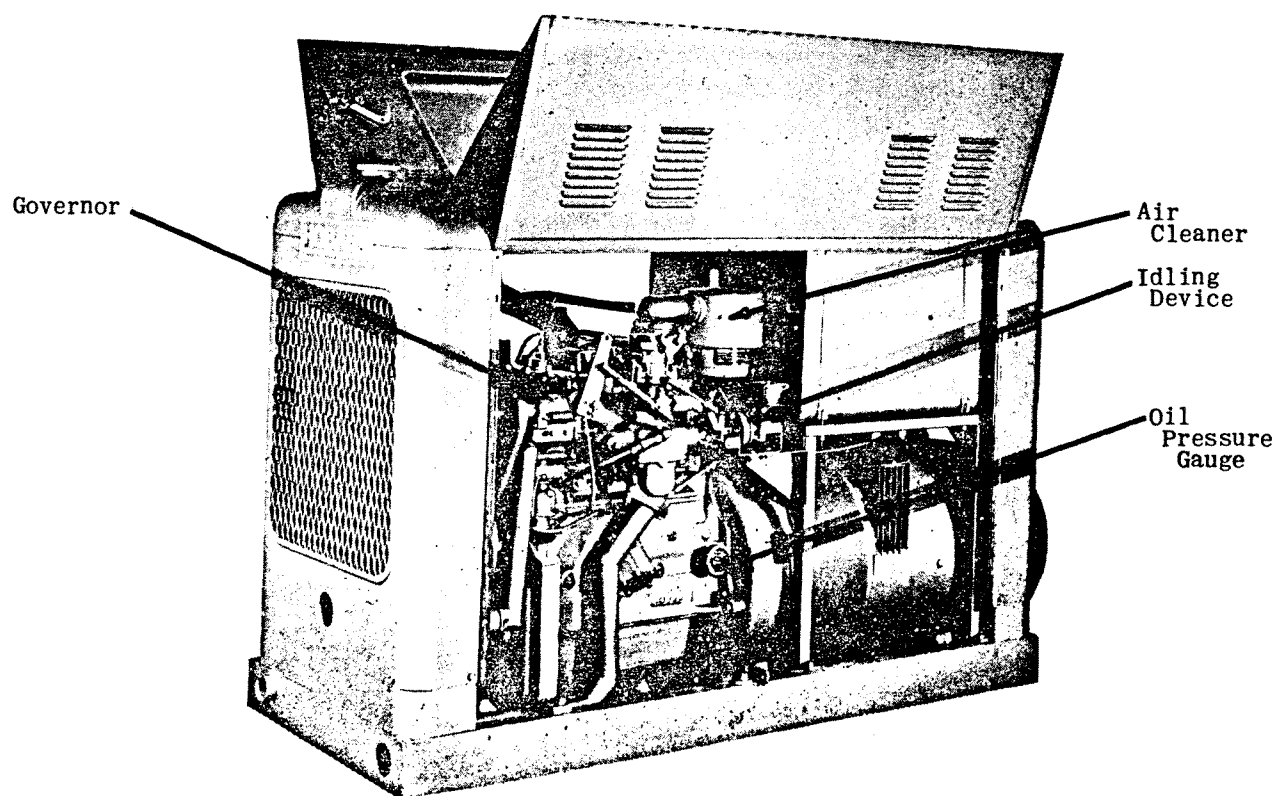
4. VARIATIONS

a. GENERAL - This book is written to deal mainly with standard Hobart 'Pipeliner' and 'Mainliner' welders. However, certain variations of these standard welders are available at the customer's option, and a few of the more common are discussed below. Most of these variations do not alter the fundamental operating characteristics of the welder. Any special instructions for the variations are included on an extra instruction sheet.

b. MAGNETO IGNITION WITH BATTERY START - When a welder is equipped in this manner, a battery charging generator, voltage regulator, battery and starting motor are added to the standard magneto ignition welder. It is also equipped with a battery charging ammeter, ignition switch and starter button to complete the controls and instruments necessary for self-starting.



Mainliner (Right Rear $\frac{3}{4}$ View)
Fig 1



Mainliner (Left Front View)
Fig 2

c. SHAFT EXTENSION - A screw-on-type shaft extension is available for both the 'Pipeliner' and the 'Mainliner' welders. It may be installed at the factory or it is available as a kit to be installed by the customer. This shaft extension makes available a source of power to drive auxiliary equipment through a series of belts and pullys, or direct, through a flexible-coupling.

d. POLARITY SWITCH - The polarity switch is standard equipment on 'Mainliner' welders, but not on 'Pipeliner' units. However, this switch is also available, as an option, on the 'Pipeliner' welders. This switch serves to reverse the polarity of the welding terminals so that it becomes unnecessary to interchange the welding cables when doing work requiring a change of polarity.

e. ELECTRIC IDLING DEVICE - This idling device, performs the same function as the standard vacuum-type idling device. The electric idling device, however, operates by using current from the main generator fields. The device will not affect the welding characteristics of the welder.

This idling device will close the throttle of the engine, 12 to 15 seconds after welding has stopped. Idling speed is then maintained until the arc is again struck. Immediately on restriking the arc the idling device will allow the governor to open the throttle of the engine so that normal welding speed is obtained.

The idling device and the governor are linked to the throttle in such a manner as to allow the idling device to close the throttle without resisting the governor action. When welding, the governor controls the engine speed without interference from the idling device. A toggle switch, on the idling device box, makes it possible, for special welding applications, to make the idling device inoperative.

f. CANOPY DOORS - Canopy doors are standard equipment on the 'Mainliner' welders, but not on the 'Pipeliner' welders. However, canopy doors for the 'Pipeliner' units are available as an extra option. These doors serve as a protection from inclement weather, and can be padlocked in place to guard against pilferage, vandalism or unauthorized operation.

PART TWO

OPERATING INSTRUCTIONS

SECTION 3 - RECEIPT OF EQUIPMENT

5. UNLOADING - When unloading from a railroad car, truck, or carrier of any kind, remember, this welder is valuable equipment - USE CAUTION.
6. UNCRATING - As a general rule it is best to move the equipment to the location where it is to be used before removing the crate. In removing the crate USE CARE when bars, hammers, etc, are used so that the equipment inside is not damaged.
7. PACKING LIST - Check the equipment received against Hobart Brothers' invoice to make sure the shipment is complete and the equipment is undamaged. If the equipment has been damaged in transit, NOTIFY CARRIER (railroad, trucking company, etc.) at once and file a claim for damages. If the shipment is incomplete or in error, write or wire:

ORDER DEPARTMENT
Hobart Brothers Company
TROY, OHIO

- Giving: 1. Order number.
2. Serial number of machine.
3. Full description of parts in error.

SECTION 4 - INSTALLATION OF UNIT

8. INSTALLATION PROCEDURE

a. GENERAL INSTALLATION - Care should be taken to so locate the machine that there will be as little opportunity as possible for excess moisture, dust, paint spray, or corrosive fumes to be drawn into the unit. Moisture condenses on generator parts and electrical controls causing corrosion which can seriously affect operation and efficiency of the unit. Dust and dirt cause needless extra wear on all moving parts.

b. INDOOR INSTALLATION

(1) If the unit is to be operated inside a building, make certain there is adequate ventilation to carry off escaping exhaust fumes and to provide an ample supply of oxygen.

(2) Place the unit so that the exhaust fumes are carried out of the building with the fewest number of bends in the exhaust line as possible.

(3) All gas exhaust connections must be gas-tight.

(4) Provide at least 2 ft. of space on all sides of the unit for ventilation and servicing.

c. PORTABLE INSTALLATION - These above instructions also apply when the unit is installed on a truck, trailer or other portable device.

d. NOTE - The unit should be operated in as near a normal horizontal position as possible, and never at a tilt greater than 15° from horizontal.

9. INITIAL PREPARATION FOR USE

a. Whether the unit is shipped wet or dry, the following steps should be taken to to prepare the new machine for use.

b. Inspect the unit thoroughly to be sure that it is in proper working order. Check all fuel and wire connections to be certain they are secure. Tighten any loose screws, nuts, or bolts. Check closely for any damage which may have occurred in transit.

c. Remove all special tags from the machine, read carefully and follow any special directions they may carry. Keep tags with book for future reference.

d. Check that the oil-pan drain plug is closed.

e. Be sure also that the cooling system drain plugs, at the base of the radiator and the right side of the engine, are closed.

f. Fill the crankcase and the air cleaner with the correct seasonal grade of a quality detergent oil.

g. Perform all other engine lubrication recommended in the lubrication section. (DO NOT grease the generator bearing).

h. Wipe off the entire unit, being certain that all radiator air passages and cooling fins are free from foreign matter. Use compressed air to blow dirt and dust out of the cooling passages and the control cabinet.

i. Fill the gasoline tank with a clean regular grade (68-80 octane) gasoline which is free from water and other foreign matter. Make sure the air vent to the gas tank is open.

j. Fill the radiator to a point about $1\frac{1}{4}$ in. below the filler neck with clean SOFT water. In summer a rust inhibitor should be added to the coolant. In winter add a permanent anti-freeze to protect the unit to a point below the minimum expected temperature.

k. Check the battery electrolyte level. The electrolyte should come to the point indicated on the battery or to a point $\frac{3}{8}$ in. above the plates.

l. Attach the battery cables to the poles of the battery as indicated on the wiring diagram. The negative (-) pole should be grounded to the frame of the welder.

m. After the engine has been properly prepared for use it should be started (read following sections on controls and operation) and allowed to idle while it is carefully checked again for leaks and loose connections.

SECTION 5 - CONTROLS, INSTRUMENTS, AND OUTLETS

10. ENGINE CONTROLS

a. **THROTTLE** - Correct throttle control is maintained automatically by the governor and the idling device. The governor maintains the engine speed at 1800 rpm. while the unit is being used for welding. Under no load the idling device retards the engine speed to 900 rpm. The governor should not be re-adjusted unless it is obviously not functioning properly. (See Para. 50) The idling device may be turned off if the idling characteristics are not desired by the weldor. (See Para. 52)

b. **CHOKE** - On battery equipped welders the choke is located to the left of the start pushbutton. On magneto equipped welders with hand start the choke is located on the front canopy panel. Pull the choke 'out' when starting a cold engine, and push it in gradually as the engine warms up. After the engine is warm and running smoothly, the choke should be pushed 'in' all the way.

c. **IGNITION SWITCH** - On battery equipped welders a keylock ignition switch is located below and to the right of the battery charging ammeter. On magneto equipped welders with hand start, a toggle type ignition switch is located below the choke on the front canopy panel. The ignition switch must be on before the welder can be started.

d. **STARTER PUSHBUTTON** - This button is supplied only on battery equipped welders with self-starter. Pushing this button closes the electrical circuit to the starting motor which cranks the engine.

e. **IDLING DEVICE** - The idling device is a device which automatically shuts the gasoline engine down to idling speed in 10-15 sec. after welding has been stopped. To bring the engine to normal welding speed it is only necessary to strike an arc. The idling device and governor are linked with the throttle in such a manner that the device can close the throttle without having to resist the governor action. When welding, the governor controls the engine speed without any interference from the idling device. This device can be turned off without affecting the welder or gasoline-engine operating characteristics by placing the locking arm (on the idling device) in the full clockwise position.

11. GENERATOR CONTROLS

a. **GENERAL** - The welding current is controlled and regulated through two different controls. A multi-range switch is the primary or 'coarse' adjuster of the welding current and provides 100 steps within each of the 5 ranges. A polarity switch, provided as standard equipment on the 'Mainliner' and as an optional component on the 'Pipeliner', provides for straight or reverse polarity at the output terminals.

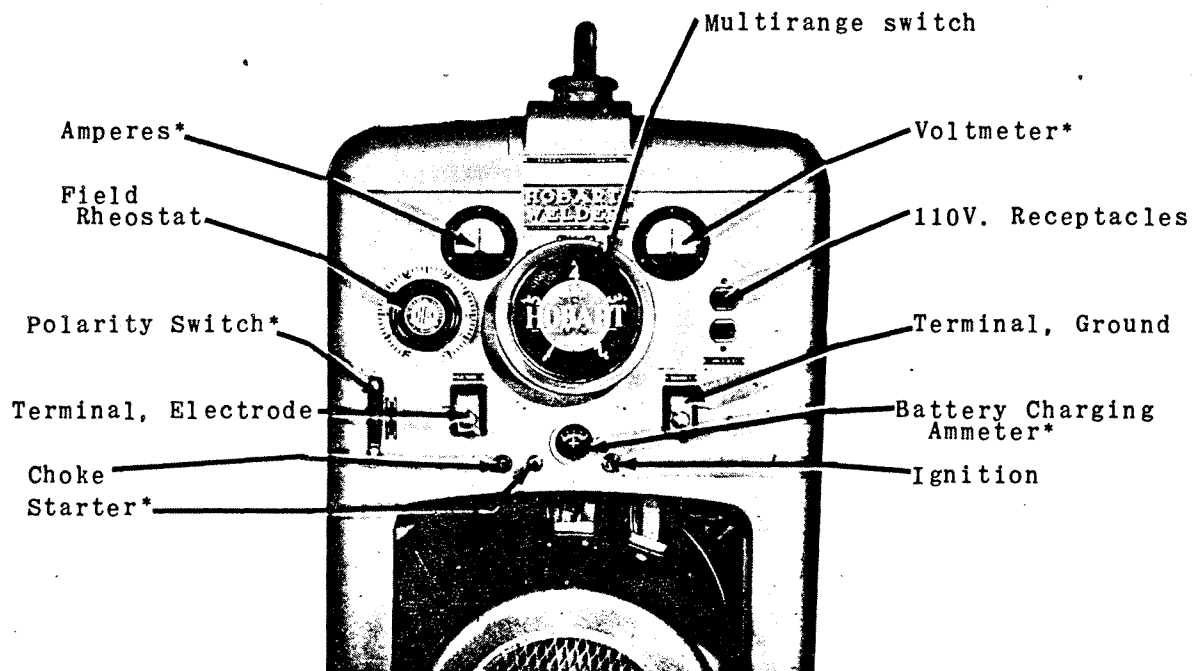
b. **MULTI-RANGE** - The multi-range switch is the large handwheel, located in the center of the generator control panel, (See Fig.3) This switch controls the primary welding current and is adjustable through 5 ranges. Turning the switch handwheel clockwise will increase the current while turning it counter-clockwise will decrease the current. To set the switch correctly, the arrow on the switch, for any particular range, must line up exactly with the arrow on the control panel. The switch is equipped with a detent which indicates when the switch is correctly set.

CAUTION

Do not attempt to weld with the multi-range switch set between two ranges.
Do not adjust the switch under load.

c. FIELD RHEOSTAT - The field rheostat is the small handwheel located to the left of the multi-range switch. (See Fig. 3) This control is used to make fine current adjustments, no matter in which of the primary ranges the unit is operating. Turning the field rheostat handwheel clockwise will increase the welding current and open circuit voltage in very fine steps, while turning the handwheel counter-clockwise will decrease the welding current and open circuit voltage in very fine steps.

d. POLARITY SWITCH - The polarity switch, when provided, is the toggle type, three position switch located just below the field rheostat. The operation of this switch reverses the direction of the exciter current through the generator shunt fields which, in turn, causes the cable connecting terminals to reverse polarity. When the switch is in 'UP' position the welder will operate on straight polarity and the meter hands (if machine is equipped with factory installed meters) will swing to the right. When the switch is in the center position it is neutral and the meter hands will remain at 0. When the switch is in 'DOWN' position the welder will operate on reverse polarity and the meter hands will swing to the left. The use of this switch makes it unnecessary to change the welding cables from one terminal to the other when a particular welding job requires a change in polarity of the welding current.



CONTROL PANEL
(Mainliner Battery Ignition)
Fig. 3

All items are standard on Mainliner.

*These items are optional on the pipeline.

12. POWER OUTLETS

a. **WELDING TERMINALS** - The two welding terminals are located on the generator control panel, one on either side of and slightly below the multi-range switch. The terminal on the left is the 'Electrode' terminal. The cable to which the electrode holder is attached is normally affixed to this terminal. The terminal on the right is the 'Ground' terminal. The cable that is attached to the work is normally affixed to this terminal. Make sure that all connections are clean and tight in order to insure a good electrical contact.

b. **OUTLET RECEPTACLES** - Two output receptacles located to the right of the multi-range switch provide power for the operation of small D.C. power tools and lights. Normally these receptacles will be connected to supply 1kw. of 110 volt D.C. In some special machines these receptacles may supply a total of 1 or 3 kw. of 220 volt D.C. Check the generator identification plate for correct rating before connecting a load to these receptacles.

13. INSTRUMENTS

a. **WELDING AMMETER** - The welding ammeter (when furnished) is in the upper left corner of the generator control panel. It is a center reading meter with a range from 0 to 400 amps.

The purpose of the welding ammeter is to measure the amount of current that is being used to weld. However, the ammeter also indicates polarity by the direction the pointer moves when welding is being done.

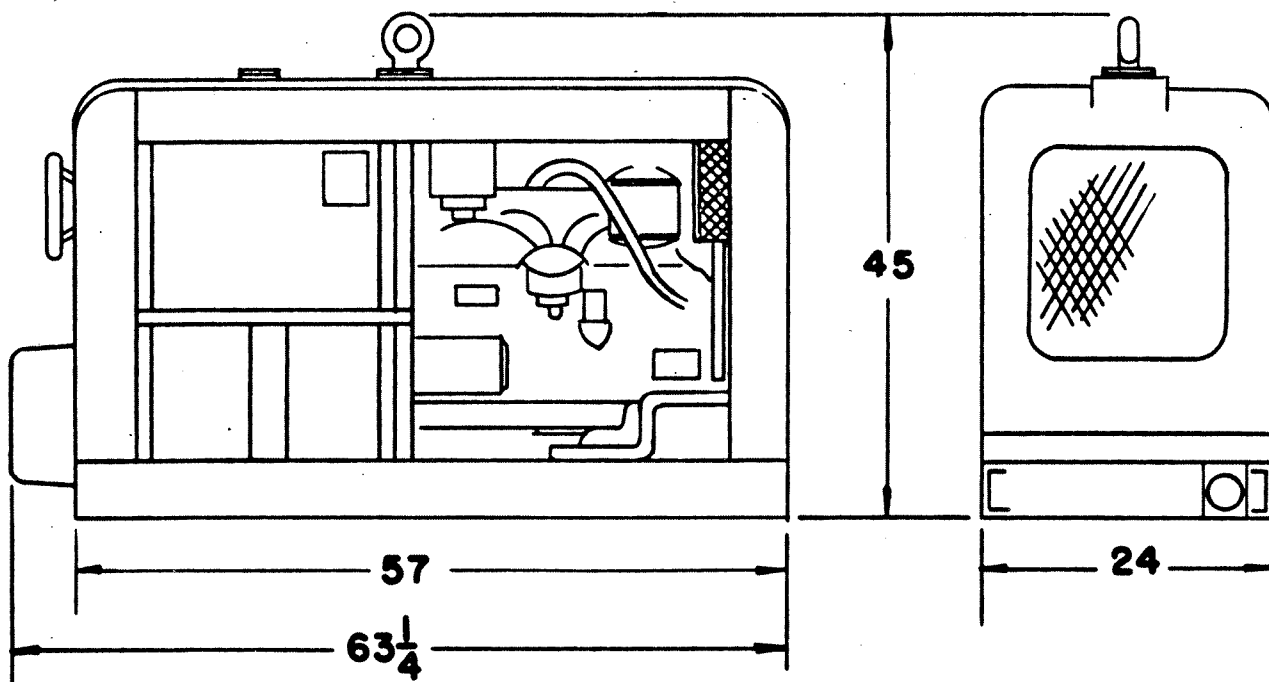
b. **WELDING VOLTMETER** - The welding voltmeter (when furnished) is in the upper right corner of the control panel. It is a center reading meter with a range from 0 to 100 volts.

The purpose of the voltmeter is to register the voltage generated by the welding generator. The voltmeter on open circuit, should register 75 to 95 volts but will drop to between 25 and 45 volts when welding is being done. The voltmeter, like the ammeter, indicates polarity by the direction the pointer on the voltmeter moves.

c. **BATTERY CHARGING AMMETER** - This meter (furnished on battery equipped units) is located on the lower portion of the rear control panel. It is a center reading meter which indicates the amount of electricity flowing into or out of the battery. The position of the ammeter needle during normal operation should be zero or plus two or three amps.

d. **OIL PRESSURE GAUGE** - This gauge is on the left side of the engine, just in front of the flywheel housing. It is calibrated in pounds of pressure from 0 to 75 lbs. In normal operation, the gauge should indicate a pressure of between 20 and 40 lbs.

e. **FUEL GAUGE** - A fuel gauge is located on the right side of the fuel tank. This gauge indicates the approximate reserve of fuel in the tank. (Tank capacity 24 gal.).



OUTLINE AND DIMENSION
Fig 4

SECTION 6 - OPERATION OF THE ENGINE

14. PRE-STARTING INSTRUCTIONS

a. Inspect the unit thoroughly to be sure it is in proper working order. Check all fuel and wire connections to be certain they are secure. Tighten any loose screws, nuts or bolts.

b. Regularly wipe off the entire unit and clean the air passages, control box and hard-to-reach places with compressed air at not over 25 psi.

c. Perform such periodic lubrication as is indicated in the lubrication section. (See Para. 28).

d. Check the oil level in the crankcase. Fill to the full mark on the oil sabre with the seasonal grade of a quality detergent oil.

e. Check the coolant level in the radiator. Fill to a point $1\frac{1}{4}$ in. below the filler neck with clean, soft water.

f. Fill the fuel tank with regular grade gasoline. Be sure the fuel is clean and free from water and other foreign matter.

g. Check the electrical system to make sure the connections are secure and properly connected. Check the battery electrolyte level.

h. Make sure that no loose bars, tools, parts, etc., are in or on any part of the engine as they could cause serious damage to or wreckage of the engine, or generator, or personal injury to anyone standing nearby.

i. If the unit is to be operated indoors, make sure that an exhaust line is properly connected to the machine.

15. STARTING THE ENGINE

a. GENERAL - Make sure the PRE-STARTING INSTRUCTIONS have been carried out. Open the side door panels. Open the fuel-line cut-off valve located at the bottom of the fuel tank.

b. HAND CRANK - When the welder is equipped with a magneto and hand crank, place the ignition switch, on the front canopy panel, in the ON position. Engage the starting crank, and pull up clockwise with a quick quarter-turn of the crank. Repeat this operation if the engine does not start on the first attempt. When the engine is cold, use the choke. The engine, under normal conditions, should start on the second or third attempt.

CAUTION

When hand-cranking - DO
NOT attempt to spin the
engine.

c. SELF-STARTER - When the engine is equipped with a self-starter, turn the ignition switch ON (turn key clockwise), and push the starter pushbutton until the engine fires. Use the choke if necessary.

CAUTION

DO NOT crank the engine longer than 30 seconds at a time. If the engine does not start in 30 seconds, allow starter to cool for one minute before attempting again to start the engine.

16. AFTER THE ENGINE STARTS

a. Check the oil pressure gauge on the left side of the engine block to make certain it is registering properly. If it is not registering a steady pressure within 30 seconds, stop the engine immediately and inspect the lubricating system and the oil level in the crankcase.

b. Adjust the choke to a point where the engine runs without missing. As the engine warms-up, the choke should be pushed in all the way. DO NOT use the choke to enrich the fuel mixture, except when starting the engine. NEVER operate the engine, after it reaches normal running temperature, with the choke partly closed.

c. Warm up the engine by running it for a few minutes at the idling speed. (900 rpm).

d. While the engine is warming up check the engine components for leaks and loose connections.

17. STOPPING THE ENGINE

a. Disconnect the welding load.

b. Allow the engine to idle for a few minutes to cool valves and pistons.

c. Turn the ignition switch 'OFF'.

d. If engine oil is to be changed it can be done more effectively while the engine is still warm.

18. OPERATION IN COLD WEATHER

a. GENERAL - Operation of engine driven welding units at sub-zero temperatures requires special precautions and extra servicing from both operation and maintenance personnel if poor performance or total functional failure is to be avoided. Equipment can be operated more satisfactorially in extremely cold weather if the following preparations are made.

b. FUEL SYSTEM - The complete fuel system should be cleaned to remove any water that may have accumulated in the system. Care should be taken that there are no pockets in the fuel lines in which water can collect and freeze, shutting off or reducing the flow of fuel. Fuel tanks should be kept FULL to prevent water condensation from the air above the fuel. Check the filter bowl daily as water may collect here, freeze, and crack the bowl.

c. FUEL - Correct fuel storage and handling will do a great deal to eliminate cold weather fuel problems. Keep fuel storage drums as full as possible to avoid condensation of moisture from the air above the fuel. After filling or moving fuel containers allow fuel to settle before using. Never draw fuel from the extreme bottom of the container. Strain all fuel to remove WATER and other foreign matter. When operating outdoors, take steps to prevent the entry of snow, water, and ice into the fuel containers. Add a pint of de-natured alcohol to fuel tanks each time they are re-filled. The alcohol mixes with the water, preventing freezing and allowing the alcohol-water mixture to burn through the engine, keeping the fuel system free of water.

d. COOLING SYSTEM - On liquid cooled engines, the cooling system should be drained, and flushed to remove accumulations of rust and sediment. Mix and add anti-freeze solution for the lowest temperatures expected. After adding the anti-freeze solution, check the cooling system connections for leaks.

e. RADIATOR - In extremely cold weather it is often wise to reduce the exposed area of the radiator by covering the lower portion with canvas or some other material. The area covered can be varied according to the temperature. If the water temperature can be kept between 160° and 180°F., the engine will operate practically as efficiently as in warm weather.

f. LUBRICATION - The engine crankcase should be drained while the engine is warm and refilled with a lighter grade of oil. Follow the recommendation given in the lubrication section. In cold weather drain oil more frequently. Water condenses and collects quickly mixes with the oil, and increases carbon deposits to form a sludge. Check oil frequently for sludge and water. Water in the crankcase may freeze and shut off the oil supply, or do serious damage to the oil pump.

g. ELECTRICAL SYSTEM - The complete electrical system should be checked for loose connections. The spark plugs, and the distributor or magneto, on machines having these components, should be cleaned and the gaps re-set. For proper gaps, consult the Engine Instruction Manual.

h. BATTERY - Battery efficiency decreases sharply with decreases in temperature. Maintain the specific gravity of the battery between 1.275 and 1.300. Make certain the battery is fully charged before attempting sub-zero starting. If necessary, use an auxiliary battery for starting.

19. OPERATION IN EXTREMELY DUSTY CONDITIONS

a. GENERAL - Operation of welding units in extremely dusty conditions also requires some special precautions and extra servicing by operation and maintenance personnel. If the following suggestions are carefully observed, more satisfactory operation under dusty conditions will be obtained.

b. LOCATION - If the unit is to be operated under dusty, out-of-doors conditions, place the unit in a sheltered area. Take advantage of any natural barriers which may offer protection from blowing dust. If the installation is more than temporary, erect a protective shield. On models equipped with canopy doors, the canopy on the right side of the machine - side away from the generator ventilator outlet - may be lowered and the machine turned so that this side faces the wind.

c. FUEL SYSTEM - Drain the fuel-pump sediment bowl frequently, and keep all fuel containers covered and protected against dust entry.

d. OIL FILTER AND AIR CLEANER - The oil filter and air cleaner need more frequent attention under dusty conditions. Check oil-filter cartridge and air-cleaner daily. Replace oil-filter cartridge as needed. Wash element and change oil in the air cleaner as required.

e. CRANKCASE - The crankcase level will bear close attention. Dusty conditions tend to load crankcase oil with dirt. Watch for dirty and gritty oil conditions and change oil at more frequent intervals as required.

20. OPERATION IN HOT AND HUMID CONDITIONS

a. GENERAL - Operation of welding units in hot and humid conditions requires some special precautions on the part of the operating and maintenance personnel. If the following suggestions are observed carefully, more satisfactory operation under hot and humid conditions will be obtained.

b. COOLING SYSTEM - Elevate welder 6-8 in. above floor or ground to provide adequate circulation of air. Remove side doors if the unit is so equipped. Maintain a more frequent check of the water level in the radiator.

c. BATTERY - The specific gravity and proper level of the battery electrolyte should be maintained. In hot climates batteries tend to self-discharge if they are not in use.

21. STORAGE

a. NIGHTLY - After operation, the following steps should be taken before storing the welder for short lengths of time:

(1) Clean up around the working area. Put all tools, parts, and supplies in their proper places.

(2) Disconnect the ground and electrode cables from the machine. Coil them and put them in their proper place.

(3) Lower side canopy doors if equipped, and lock in place.

(4) If unit is to be stored out-of-doors, it is wise to cover the unit with a tarpaulin.

b. LONG PERIODS OF TIME - If the unit is not to be used for 30 days or more, it is recommended that the fuel tank, carburetor, fuel pump, and fuel lines be drained dry, and a tarpaulin be used to cover the unit for protection from dirt, dust, and water.

SECTION 7 - OPERATION OF THE WELDING UNIT

22. BEFORE STARTING THE ENGINE

a. Attach the electrode cable to the left terminal on the control panel, and connect the ground cable to the right terminal. Use a wrench to tighten the wing

nuts with a slight pressure, to insure a good electrical contact. CAUTION! DO NOT twist cables or use a hammer to tighten or loosen connections.

b. Attach the ground cable to the work metal making certain that the connection is clean and secure. Insert an electrode in the electrode holder. If an electrode requiring straight polarity has been inserted, the standard 'Pipeliners' is now connected for welding. On the standard 'Mainliner' the polarity switch must be placed in the 'UP' or 'STR' position. If an electrode requiring reverse polarity is to be used, the terminal connections on the 'Pipeliners' must be reversed, while on the 'Mainliner' it is necessary only to place the polarity switch in the 'REV' or 'DOWN' position.

c. Set the multi-range switch on position 1 and adjust the field rheostat to its maximum position. (Turning the field rheostat clockwise increases the welding current and open circuit voltage, while turning it counter-clockwise decreases the welding current and open circuit voltage). When the rheostat is in this position, the voltmeter should indicate an open circuit voltage of between 75 and 95 (see par. 13 b) volts while the welder is running under no load.

d. Start the engine and check for its proper operation.

23. GENERAL OPERATION

a. Check that the open circuit voltage is between 75 and 95 volts (see par. 13b) when the rheostat is in the max. position.

b. Strike an arc to begin welding. If the setting of the multi-range switch in position 1 is too low, select the lowest range possible and then make fine adjustments with the field rheostat until the desired current is obtained. In setting the multi-range switch, be certain that the arrow on the switch coincides with the arrow on the control panel. A detent stop indicates when the switch is in the correct position.

c. Approximate ampere ratings of each range are given in the following chart.

Multi-Range Switch Setting	Field Rheostat Set At	
	Min.	Max.
1	25	65
2	65	115
3	90	215
4	165	320
5	290	360

Current values shown above are related to 25 volts across the arc, corresponding to that used with a medium coated electrode. When using heavily coated or carbon electrodes, or when using extra long cables, the values in the table are proportionately reduced, due to the higher voltage drop involved.

d. Before stopping the engine, the welding cables should be disconnected from the load, along with any auxiliary load on the outlet receptacles.

SECTION 8 - SAFETY

24 EYEBURN

a. DEFINITION - Eyeburn is the painful burning of the eye caused by exposure to arc rays. To prevent eyeburn it is necessary that the eyes of the weldor, as well as the eyes of others nearby be shielded by arc-proof glasses. Ordinary sun glasses or gas-welding goggles do not provide sufficient protection.

b. REMEDY FOR EYEBURN - In case of eyeburn, the eye will not be permanently injured, but the pain may be intense for as long as 24 to 48 hours. Immediate relief may be obtained by placing a drop of Butyn in the affected eye. It acts as an anesthetic and lasts about two hours. Two applications are usually sufficient. If Butyn is not available, treat the eye with sweet oil once every hour, until the acute burning sensation has disappeared, during which period the pain may be relieved by ordinary doses of aspirin. A solution of Argyrol may be used afterward as an aid to healing, but should be used not more than once every five hours.

25. PROTECTION FROM ELECTRIC SHOCK - Fundamentally it should be kept constantly in mind that all electric circuits, whether A.C. or D.C., high or low voltage, are a potential source of danger. Voltages required for arc welding are low and normally will not cause injury or severe shock. However, these voltages are sufficiently high to be potential source of serious shock under certain conditions.

One of the principal dangers from low voltage welding circuits is the assumption that they can be handled carelessly, without injurious consequences. The only way to be safe is to handle any electrical circuit with extreme caution.

High humidity and dampness of the operator's clothing reduce electrical resistance and increase the possibility of noticeable shock from any type of arc welding equipment. For this reason, protective equipment such as gloves, aprons, sleeve protectors, and jackets should be kept dry and in good repair, and used whenever welding is being done.

Protection from electric shock is dependent primarily on common sense and the recognition of the dangers involved. Pertinent precautions which should be observed are as follows:

a. Check the machine and cable lead insulation every three months for damage and wear. Use only approved welding cables in good repair.

b. Stand on a dry wooden mat or similar insulating material when welding.

c. Wear jackets or aprons, sleeves, and dry gloves when welding.

d. Do not permit electrode holder to touch bare skin or damp clothing operator may be wearing.

e. Do not put energized electrode holder under arm at any time.

f. Do not touch nearby personnel with electrode or holder at any time.

g. Do not cool hot electrode holders in water. This practice exposes the operator to electrical shock.

h. All cable couplings or splices should be fully insulated.

i. DO NOT CHANGE CABLE CONNECTIONS WHILE THE ENGINE IS RUNNING.

26. ENGINE

a. Never fill the gas tank while the engine is hot or in operation.

b. Never operate the unit in a closed building unless the exhaust is piped outside. The exhaust contains carbon monoxide, a poisonous, ODORLESS, and invisible gas, which if breathed into the lungs will cause serious illness or possible DEATH.

c. Never make adjustments on the unit while it is connected to the engine without first removing the ignition cables from the spark plugs.

d. Never leave tools or parts on the operating machine as they could get among the moving parts and cause serious harm to the machine or nearby personnel.

CAUTION

ALWAYS BE SURE TO SHUT THE FUEL TANK VALVE OFF WHEN THE WELDER IS NOT IN USE. IF THIS PROCEDURE IS EGLECTED THE FUEL WILL CONTINUE TO FLOW AND WILL GET IN THE ENGINE CRANKCASE.

SECTION 9 - LUBRICATION

27. WELDING GENERATOR

a. GENERAL - There is only one place on the generator of the gas-driven arc-welder that requires lubrication. This is the end bearing. This bearing is packed with enough grease when the machine leaves the factory to last 6-8 months under the most severe use. After this initial period, the manufacturer suggests that the machine be lubricated on the 1st of January and the 1st of June of each year.

b. PROCEDURE - To lubricate the end bearing remove the brush-holder cover, and clean the area around the bearing cap. Then remove the three bolts that hold the bearing cap to the housing. Remove as much of the old grease as possible and wash out the cap and the bearing with kerosene or warm diesel fuel. DO NOT use gasoline! Fill the clean bearing cap about 1/3 full of the recommended lubricant and smear a small amount of the lubricant over the end of the shaft. Place the cap in position and bolt tightly.

Pressure fittings are not recommended because the grease, under pressure may go through the bearing grease seal and onto the commutator causing serious difficulty or reduction of welder efficiency.

c. CLEANLINESS - Dirt is responsible for more ball bearing failures than any other cause. Dirt may get into the grease when the bearing cap is removed for inspection. Therefore, DO NOT inspect or lubricate the bearing more often than every six months. Over lubrication, together with unclean lubrication ruins more bearings than neglect. Always wipe clean the area around the bearing cap before removing it.

d. LUBRICANT - Ordinary cup grease is not a satisfactory grease for the lubrication of ball bearings. Use only a clear, non-corrosive, heat resistant, medium bodied grease. Such a grease H.B. No. 354, is available from Hobart Brothers in 1 and 5 lb. containers. DO NOT use a graphite lubricant.

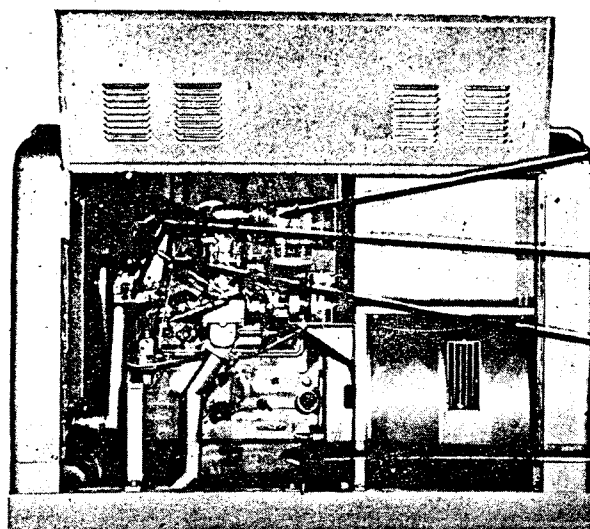
28. ENGINE AND ATTACHED COMPONENTS

a. GENERAL - The standardized Lubrication Chart in this manual is designed to simplify the job of lubrication. It shows the points to be lubricated and the type of lubricant to be used. A further discussion of the procedure and the lubricant to be used in lubricating the CRANKCASE, AIR FILTER, OIL FILTER, DISTRIBUTOR, MAGNETO, GENERATOR, STARTING MOTOR, and WATER PUMP can be found in the Willy's Engine Instruction Manual.

b. GOVERNOR - The oil level in the governor should be checked weekly, and the governor kept full to the oil-level plug. Use the same seasonal grade of oil used in the crankcase. Every 6 months the governor should be drained (drain plug located on bottom of governor), FLUSHED, and refilled with the correct seasonal grade of oil.

c. THROTTLE LINKAGE - The throttle linkage from the idling device and the governor should be oiled weekly with SAE-10 oil.

29. TRUCK ASSEMBLY - If the welder is mounted on a Hobart truck assembly, all lubrication points of the truck should be serviced at the same time the generator bearing is lubricated.

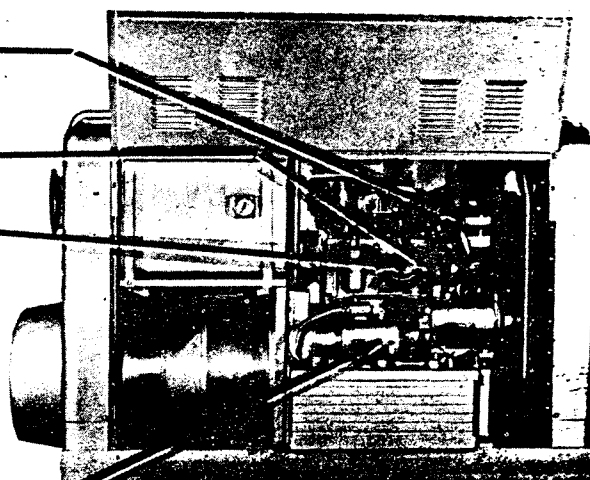


Operating Hours Lubricant

8	OE	AIR CLEANER (Check level and re-fill. Every 64 hours remove, drain, clean and re-fill. Every 256 hours remove and wash all parts.)
50	OE	GOVERNOR (Check and re-fill to level. Every 1000 hours drain and flush with one pint OE)
50	OE	GOVERNOR THROTTLE AND CONTROL LINKAGE
EVERY 6 MO.	WB	WELDING-GENERATOR BEARING
50	--	CRANKCASE (See Note)

Operating Hours Lubricant

50	OE	OIL FILTER (Drain filter and renew cartridge when crankcase oil is changed.)
50	OE	CRANKCASE FILLER (Fill crankcase every 50 hours of operation.)
25	OE	DISTRIBUTOR (Place several drops of OE-SAE-10 in oiler at side of distributor housing; also a drop of oil on wick in shaft under the rotor, and sparingly apply soft grease on the breaker-arm cam, and a drop of OE-SAE-10 on breaker-arm pivot.)
500	OE	MAGNETO (Use OE to lubricate cam wiper-felt. Apply no more oil than can be absorbed by wick. Wipe off excess.)
50	OE	GENERATOR AND STARTING MOTOR (Place 3 to 5 drops in oilers.)



NOTE - The water pump bearing is pre-lubricated, and the lubricant lasts for the life of the bearing.

See page 18b for key to symbols and additional notes on lubrication.

LUBRICATION CHART Fig. 5

- KEY AND NOTES -

LUBRICANTS	LOWEST EXPECTED AIR TEMPERATURE			LUBRICANTS
	Above 0° Centigrade (32°F)	0° Centigrade to -16.6° (32°F to 0°F)	Centigrade Below -16.6° Centigrade (0°F)	
OE Oil, Engine				
Engine Crankcase	OE-SAE-30	OE-SAE-10	OE-SAE-10	WB-Grease-General
Air Cleaner	OE-SAE-30	OE-SAE-10	Same As Crankcase	Purpose No. 2
Governor	OE-SAE-30	OE-SAE-10	Same As Crankcase	
Other Points	OE-SAE-10	OE-SAE-10	OE-SAE-10W	WP-Grease
Grease, General Purpose	CG NO.1	CG-NO.0	CG NO.0	Water Pump

FITTINGS - Clean before applying lubricant.

HOURS - Reduce hours under severe operating conditions.

CLEAN parts with SOLVENT, dry cleaning or OIL, fuel, Diesel. Allow parts to dry thoroughly before lubricating.

CRANKCASES - Drain only when hot. Re-fill to FULL mark on gauge. Run engine a few minutes and re-check oil level.

CAUTION: Be sure pressure gauge indicates oil is circulating.

OIL CAN POINTS - Every 64 hours, lubricate throttle and governor control linkage with OE (SAE-10).

SECTION 10 - PREVENTIVE MAINTENANCE

30. GENERAL - A proper preventive maintenance program consisting of a schedule of inspection and cleaning is the heart of good welder care and the key to long untroubled welder operation. Such a program is outlined below.

31. BEFORE-OPERATION SERVICES

a. Fill the radiator with water. Check, and if necessary, tighten all hose connections. Make sure the drain cocks are closed.

b. Fill the fuel tank. Make sure there are no leaks in the fuel line. Make sure the fuel line valve is open.

c. Bring the level of the oil in the crankcase to the 'Full' mark on the oil dipstick.

d. If the unit is battery equipped, check that the electrolyte level is approx. 3/8 in. above the plates. Add distilled water if low.

e. Inspect and if necessary tighten all electrical connections.

32. DURING-OPERATION SERVICES AND INSPECTIONS

a. OIL GAUGE - When unit is in operation, if the oil gauge shows a changing pressure, or no pressure at all, check the crankcase oil level, or check the oil lines for leaks.

b. BATTERY-CHARGING AMMETER - Check the battery-charging ammeter periodically while the unit is running to determine if the generator and voltage regulator are functioning properly.

c. OVER-HEATING - Both the engine and the generator should be checked periodically for over-heating.

d. NOISE - If any unusual vibrations or noises are noticed while the unit is in operation, it should be stopped and the source located and remedied.

33. AFTER-OPERATION SERVICES AND INSPECTIONS

a. Run engine at idling speed for a short time before turning off ignition switch.

b. Shut off engine and clean it.

c. Disconnect ground and electrode cables from machine. Coil them and put them in their proper place.

d. Clean and re-fill air filter.

e. After engine has cooled, the fuel tank and radiator may be refilled.

f. Put down side canopy panels, if unit is so equipped. If inclement weather is expected and the unit is to be stored out-of-doors, it should be covered with a tarpaulin.

34. WEEKLY INSPECTIONS

a. Check all parts for actual failure, and for wear that is just beginning to show. Defective parts should be repaired or replaced.

b. Inspect all tubing and pipe lines for leaks. Joints and fittings must be tested for tightness. Gaskets should be replaced when necessary.

c. Weekly lubrication points should be lubricated.

d. The covers should be taken off the generator and the complete unit cleaned with compressed air.

35. MONTHLY INSPECTIONS

a. Perform all weekly inspections.

b. FRAME AND CANOPY - Examine connecting nuts and bolts for tightness. Look for dents and rust spots. Dents should be pounded out and refinished. Rust spots should be sanded down, primed and refinished.

c. ENGINE

(1) Check crankcase block, head and head gaskets for cracks or leaks. Check that all bolts are tight (see Willy's engine instruction book for correct torques).

(2) Run engine and listen for piston slap, bearing knock, or carbon knock.

(3) Remove valve covers and examine valve rods, and spring and valve clearances. Replace cover gaskets if necessary.

(4) Check spark-plug, and distributor or magneto point clearances.

(5) Check oil pressure; if below normal it may indicate engine bearings are loose or worn.

d. COOLING SYSTEM

(1) Examine radiator and connections for signs of leakage, clogging, or damage.

(2) Check fan and governor belts for proper tension, and for cracking or oil soaking. Adjust fan belt so that it can be depressed approx. $\frac{1}{2}$ in. Adjust governor belt so that it can be depressed approx. $\frac{1}{4}$ in.

(3) Examine water pump for cracks or signs of leakage. Make sure the shaft rotates freely.

(4) Flush cooling system if excessive sediment build up is noticed in any of the components.

e. EXHAUST SYSTEM

- (1) Examine manifold for cracks.
- (2) Check manifold gaskets for leaks.
- (3) Examine muffler (on 'Mainliner') and exhaust pipe for leaks.

f. FUEL SYSTEM

- (1) Inspect the fuel pump, fuel-pump mounting and connections. Empty the sediment bowl and clean the filter screen.
- (2) Examine carburetor for tightness of screws and for worn gaskets.
- (3) Examine choke, throttle and governor linkage for excessive play.
- (4) Inspect fuel tank and lines for signs of leaks.

g. LUBRICATING OIL SYSTEM

- (1) Check all oil lines and connections for leaks.
- (2) Clean oil-filter and change oil-filter element.
- (3) If excessive sludge deposits are found to have built up, drain crankcase, clean with flushing oil and renew oil-filter cartridge.

h. ENGINE ELECTRICAL SYSTEM

- (1) Inspect all wires and terminals for damage, wear, and looseness.
- (2) Examine and test starter and switches.
- (3) Test battery, if unit is so equipped, and check electrolyte.
- (4) Inspect distributor or magneto. Inspect breaker points for pitting or signs of wear.
- (5) Check battery-charging-generator action for excessive arcing at the brushes. Examine for sticking or worn brushes, and for burned or damaged commutator bars.
- (6) Switches and instruments should be subjected to a thorough testing and examination.

1. WELDING GENERATOR

- (1) Check amperage and voltage of current delivered. Inspect brushes for signs of wear, and for proper spring pressure and freedom of action in holders. Examine brushholders to see if they are clean.
- (2) Check commutator for roughness, and for low, high or loose bars.

(3) Check all wiring connections, switches instruments, and controls for looseness, wear, and inaccuracy.

SECTION 11 - SPECIAL MAINTENANCE PROBLEMS

36. LOSS OF MAGNETISM

a. INDICATION - If the generator fails to build up voltage after starting, it may be due to the exciter having lost its residual magnetism in shipping or moving the unit.

b. MAINTENANCE PROCEDURE - Raise the exciter brushes and apply an outside source of D.C. voltage, not in excess of 110 volts, for a few seconds to exciter brushes of opposite polarity (adjacent brushes). This sets up a magnetic field which leaves enough residual magnetism to cause the exciter to build up voltage by itself, when the brushes are again lowered onto the exciter commutator. If, after the outside voltage has been applied the exciter still fails to generate voltage, reverse the outside voltage through the exciter brushes.

37. POLARITY REVERSED

a. INDICATION - Reversed polarity is indicated by the instruments reading in the wrong direction, when the polarity switch is in the 'straight' position and the motor is rotating in the proper direction. With the polarity switch in the 'straight' position the meters should read to the right.

b. MAINTENANCE PROCEDURE - The remedy is to raise all the exciter brushes, connect two terminals of a storage battery to any two adjacent exciter brush-holders, and pass the current through the field coils for several seconds. If the desired results are not secured, reverse the connections and repeat the procedure. A way to do this, when an outside source of D.C. current is not available, is to operate the welder with the rheostat in the 'maximum' position, with one exciter brush lifted. Then raise the diametrically opposite brush, and lower it quickly to the commutator. If carried out with proper timing the polarity will reverse, DON'T neglect to drop the brush that was first lifted.

38. BRUSH REPLACEMENT

a. INSPECTION - The brush-holder covers should be removed at least once a month and the brushes inspected. If the brushes are worn unevenly or are shorter than $\frac{3}{4}$ in. they should be replaced.

b. REMOVAL - Remove the cover at the rear of the generator if the generator brushes are to be removed, or the exciter cover at the front of the generator if the exciter brushes are to be removed. Disconnect the brush pigtail from the brush-holder with a screwdriver. Lift the brush-finger and remove the worn brush.

c. INSTALLATION - Lift the brush-finger and insert the new brush. Fasten each brush pigtail to the brush-holder and be certain that the brush-finger rests centrally upon the brush. Adjust the brush spring, in the locking washer, so that the exciter brushes bear on the commutator with a pressure of approximately $\frac{1}{2}$ to $\frac{3}{4}$ lb., and the generator brushes bear on the commutator with a pressure of $1\frac{1}{2}$ to 2 lb. Lay a commutator-wide strip of No. 00 sandpaper, smooth surface down, on the commutator and with one hand in place and pressed down on the sand-paper, draw the sand-paper

in the direction of rotation of the armature, lifting the brushes on the return stroke. Continue until all the brushes have the same curve as the armature. Do not bevel the edges of the brushes. When the brushes have the same curvature as the commutator, remove the sand-paper and blow all the carbon dust out of the machine.

CAUTION

DO NOT use emery paper to sand the brushes as the dust will short the commutator.

39. CARING FOR COMMUTATOR

a. MAINTENANCE PROCEDURE - If the commutator is dirty, apply a piece of heavy canvas directly to the commutator with a stick. A burnishing action will result which effectively removes foreign accumulation. If grease is found on the commutator it must be removed to prevent arcing. Use a solvent type cleaner, and then grease bearings more sparingly.

40. GENERATOR WINDINGS

a. Blow out dirt monthly with compressed air or remove with a suction type cleaner with a non-metallic nozzle. If the windings should become slightly damp, use space heaters or electric light bulbs to effectively dry the windings. If the dampness is excessive, apply external heat under a canvas cover, well vented. Heating should not exceed 194°F. A low voltage current can be circulated through the windings, but it should be only a fraction of the full load current, and the temperature limitation should be observed.

SECTION 12 - TROUBLE-SHOOTING CHART

TROUBLE	PROBABLE CAUSE	REMEDY
41. ENGINE		
ENGINE WILL NOT START Low cranking speed	Oil too heavy	Warm or use light oil
	Battery power low	Tighten connections; re-charge or replace with fully charged battery
	Starter power low	Tighten connections; replace starter cables, brushes, or starter
	Engine resistance high	If over-heated, allow to cool, test with hand crank. Overhaul if internally jammed.
Starter runs but does not crank	Broken drive	Replace starter.
Engine does not catch	No fuel	Check 3-way valve, fuel level, and lines
	Flooded (when cold)	Allow 5 min. for drainage, crank 10 revolutions with choke wide open, then re-set choke.
	Vapor lock (when hot)	Allow unit to cool, loosen line at carburetor and turn engine over, with ignition off, to prime fuel pump.
	Water in fuel	Clean strainer, drain fuel tank, carburetor.
	No ignition	Check switch; tighten connections or replace defective wire, magneto, or distributor
Engine splutters and stops	Mixture too lean	Use choke; check for fuel leakage
	Exhaust clogged	Clear obstruction or replace as required.
IRREGULAR OPERATION		
Missing cylinder	Fouled spark plug, shorted ignition harness	Clean or replace plug, replace defective cable
	Burned or sticking valve	Replace valves where necessary grind valves. replace springs as required
	Blown head gasket	Replace gasket
Runs ragged and cool	Mixture too rich	Clean or replace air cleaner or carburetor
	Air leak in intake	Tighten or replace defective gasket or part
Back-fires and runs hot	Mixture too lean	Clean or replace carburetor, fuel lines, strainer

Speed not steady Over-heats	Ignition out of time	Re-time magneto or distributor, and clean contact points
	Varying load	Adjust or replace governor
	Cooling system blocked	Check coolant level, thermostat, and water-pump drive, clear fluid or air-flow obstruction
	Coolant frozen (when cold)	Thaw out by off-on operation at 5-min. intervals with covering over radiator. If leakage appears in block, weld crack or replace engine.
Low power	Low oil supply	Re-fill, locate leak if oil use rises suddenly
	Over-loaded	Reduce load
	Fan belt slipping	Adjust belt tension or replace belt
	Ignition off time	Re-time magneto or distributor
Sudden stoppage	Low compression	If valve-clearance adjustment or valve grinding does not correct, overhaul engine
	Exhaust partially clogged	Clear obstruction or replace parts
	Out of fuel	Re-fill tank; check fuel feed for dirt or water, check fuel-cap tank vent.
	Ignition failure	Locate broken circuit and repair or replace
ENGINE KNOCKS	Internal engine failure	Overhaul
	Engine over-heats and 'seizes'	Cool and locate cause of overheating. If bearings are noisy on re-starting, overhaul engine
	Distributor or magneto cap cracked	Replace cap
Piston slap at warm-up	Worn pistons	Overhaul engine if noticeable when warm
Valve clatter	Excessive valve clearance	Adjust valve tappets
Heavy knock at no load	Damaged or worn bearing	Overhaul engine
Knocks under load	Low oil; bearings dry	Stop immediately to re-fill oil. Check for noise at re-starting, and for metal particles in oil when drained.
Detonation under load	Improper fuel	Either use higher grade fuel or less load
	Ignition too early	Re-time magneto or distributor

Smoky exhaust	Carbon deposits	Remove head and clean carbon
	Crankcase breather failure	If disconnecting breather stops smoke, replace breather system
Low oil pressure	Worn rings and cylinders	Overhaul engine
	Low oil supply or blocked flow	Re-fill crankcase; replace oil-filter element. Check for oil leak
	Oil too hot or too light	Reduce load until cause of overheating is located, or use heavier oil
	Relief valve maladjusted	Readjust valve. If none of above correct, overhaul engine
CARBURETOR		
Hard starting	Choke not opening or closing	Tighten wire clamp or choke lever
	Carburetor flooding	Replace float, float valve and seat, or entire carburetor if not corrected by setting float level
Rough idle	Idle mixture off	Adjust
	Carburetor dirty	Replace if cleaning does not correct condition
Lack of power	Carburetor dirty	See above
	Choke not full open	Check and re-set lever or control
	Air-filter loaded	Clean or replace. Remove oil if below 0°F.
	Throttle shaft sticking	Replace carburetor if cleaning does not correct
Leaks fuel	Loose or cracked parts	Replace carburetor if tightening does not correct
GOVERNOR		
Leaks oil	Loose joints, worn oil seal	Tighten joint bolts; replace governor if leak persists
Excessive speed	Flyweights sticking	Replace governor
	Carburetor throttle shaft stuck	Free-up or replace carburetor
DISTRIBUTOR, MAGNETO, AND IGNITION SYSTEM		
Irregular firing	Spark-plug gaps incorrect	Set to 0.030 in. or replace plug
	Spark plugs dirty, cracked	Clean or replace
	Cable defective	Replace cable
	Magneto points maladjusted	Set at 0.015 in full open
	Distributor points maladjusted	Set at 0.020 in full open
	Loose connections	Check cables
	Magneto/distributor points defective	Clean or replace points
No spark	Ignition switch closed	Check switch
	Ground cable shorted	Remove cable and check with separate ground

	Defective magneto or distributor	Test coil, condenser, if neither is bad replace magneto or distributor
Hard Starting	Impulse spring broken Defective brush at distributor	Replace magneto Replace brush and spring
42. WELDING GENERATOR		
Arcing at brushes of welding generator	Dirty or rough commutator High or side mica Worn brushes Brushes stuck in holders High commutator bar Open-circuit in armature Interpole shorted or grounded Brushholder loose	Clean and turn commutator Undercut commutator Replace brushes Clean brushes and check for size Turn commutator Repair or replace armature Replace insulation Tighten brushholder at proper setting
Fails to generate rated voltage	Engine speed too slow Dirty commutator Worn brushes or no spring tension Shorted armature coils One or more shunt-field coils shorted Brushholder setting incorrect	Set governor to maintain a speed of 1800 rpm under load Clean commutator Replace brushes, set springs to proper tension Replace armature Replace field coils Adjust to correct setting
Generates less than 10V	Open-circuit in field coil Engine speed too slow Defective rheostat or bad riveted connection Defective male and/or female receptacle Defective wiring Loss of residual magnetism Improper adjustment Improper adjustment Eyebolt maladjusted Governor-to-carburetor rod sticking	Replace field coil Increase to 1800 rpm no load Replace or repair Replace or repair Repair wiring Excite fields temporarily Re-set main adjusting screw See above Re-set eyebolt adjustment Free-up or replace rod
Excessive speed		
Speed too low		
Too sensitive		
Will not idle		
Sluggish response	Ball joints in rod sticking	See above
No-load surge	Play or binding in rod. Set-screw-maladjusted	Re-adjust, one turn at a time
COOLING SYSTEM OVERHEATING		
Fluid-flow blocked	Plugged radiator or engine jacket passages Thermostat not opening Collapsed or rotted hose	Clean by boiling soda solution and/or reverse flushing Replace engine thermostat Replace hose

Air-flow blocked	Unit improperly sited	Re-locate to clear air flow
Low air-flow	Fan belt slipping	Adjust belt tension
	Plugged radiator	Blow with compressed air from shutter side
Leakage	Radiator loose or defective	Tighten or replace radiator
	Water-pump seal worn	Replace exposed seal or entire pump
	Cracked block or head	Overhaul engine
BATTERY-CHARGING GENERATOR AND VOLTAGE REGULATOR		
No output	Short capacitors	Replace capacitors
	Sticking or worn brushes	Clean or replace brushes
	Open or shorted field or armature	Replace generator
	Defective regulator	Replace regulator
Low or unsteady output	Dirty commutator	Clean
	High mica or commutator worn	Replace generator
	Defective regulator	If cleaning points does not correct, replace regulator
	Drive-belt slipping	Adjust belt tension
	Sticking or worn brushes	Replace brushes
Excessive output	Defective regulator	Replace regulator if cleaning points does not correct
	Field grounded	Replace generator
Noisy generator	Loose mounting	Tighten bolts
	Worn bearings	Replace generator
	Brushes improperly fitted	Sand brushes to correct fit
BATTERY		
Discharged	Short-circuited wiring	Locate short and repair
	Voltage regulator defective	Replace regulator
	Generator not charging	Replace regulator
Overheating	Voltage regulator defective	Replace regulator
	Low liquid level	Add water
	Internal short	Replace battery
No output	Loose connection	Check connector completely
STARTER		
Slow speed	Worn brushes	Replace brushes
	Dirty commutator	Clean up
	Poor connection	Tighten all connections, check starter-switch contacts
Inoperative	Defective starter	Replace starter